



# **Real-Time High Performance Computing (HPC) to Support Dynamic Infrared Scene Projection (DIRSP) and Associated Virtual Proving Ground (VPG) Applications**



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*Ken LeSueur*

*Redstone Technical Test Center*

*(Co-author: Eddie Burroughs)*

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**Developmental Test Command**



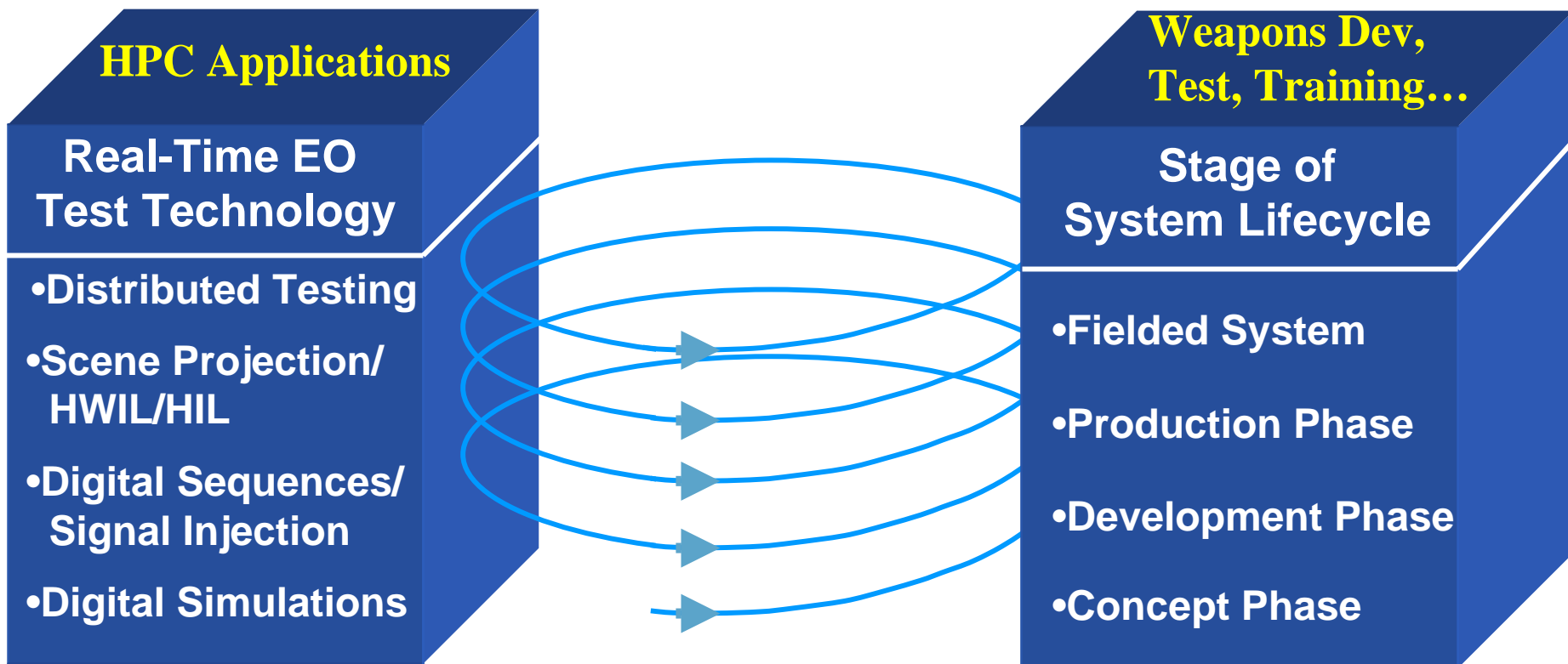
# Real-Time HPC to Support DIRSP and VPG Applications



- Presentation Focus:
  - *Test & Evaluation of Electro-Optic Weapon Subsystems/Systems*
    - *Infrared and Visible Spectrums (EO/IR)*
- Virtual Proving Ground
- Dynamic Infrared Scene Projection Technologies
- Example Application
- Conclusions

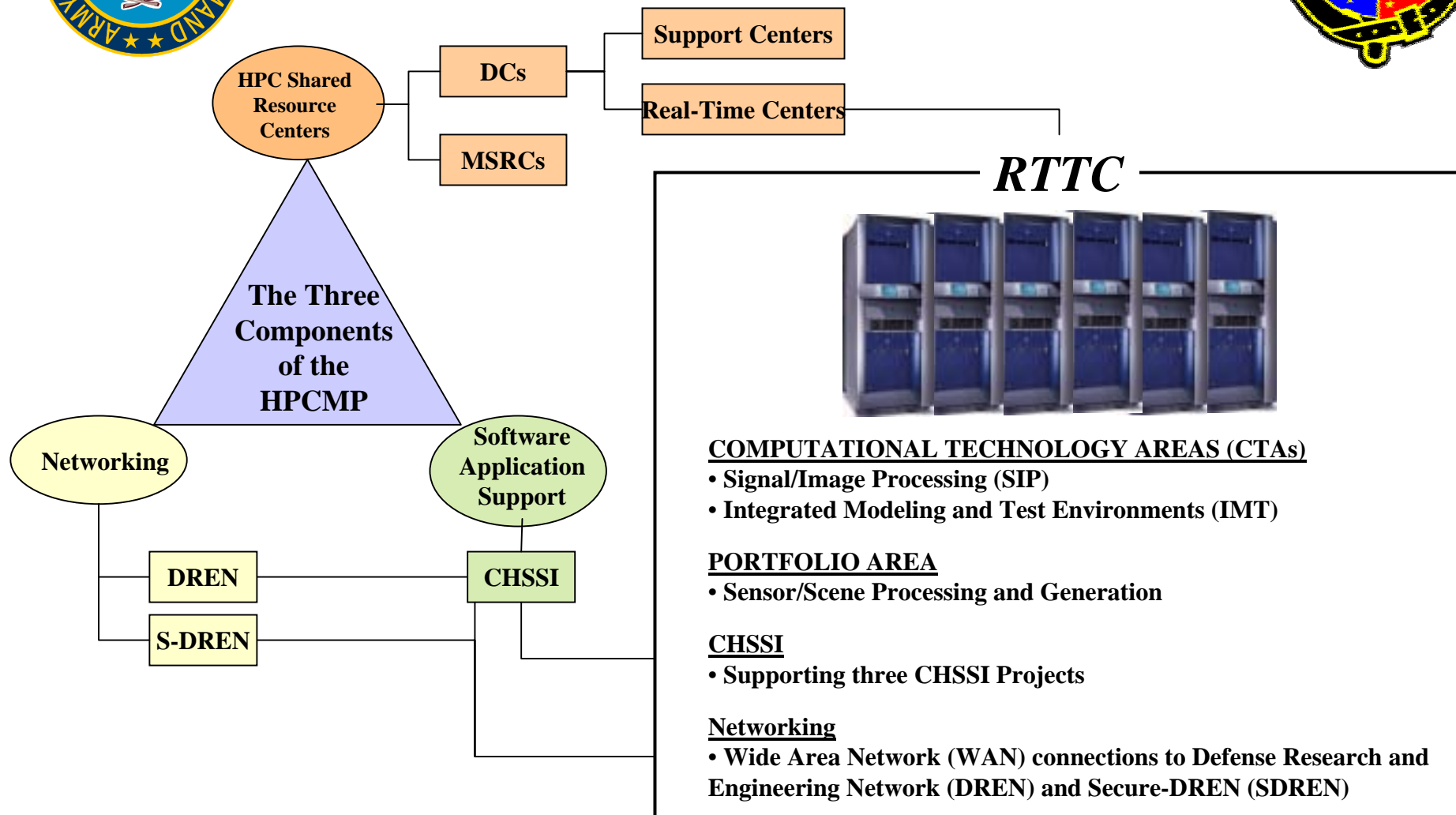


# RTTC's HPC Applications Benefit the Warfighter





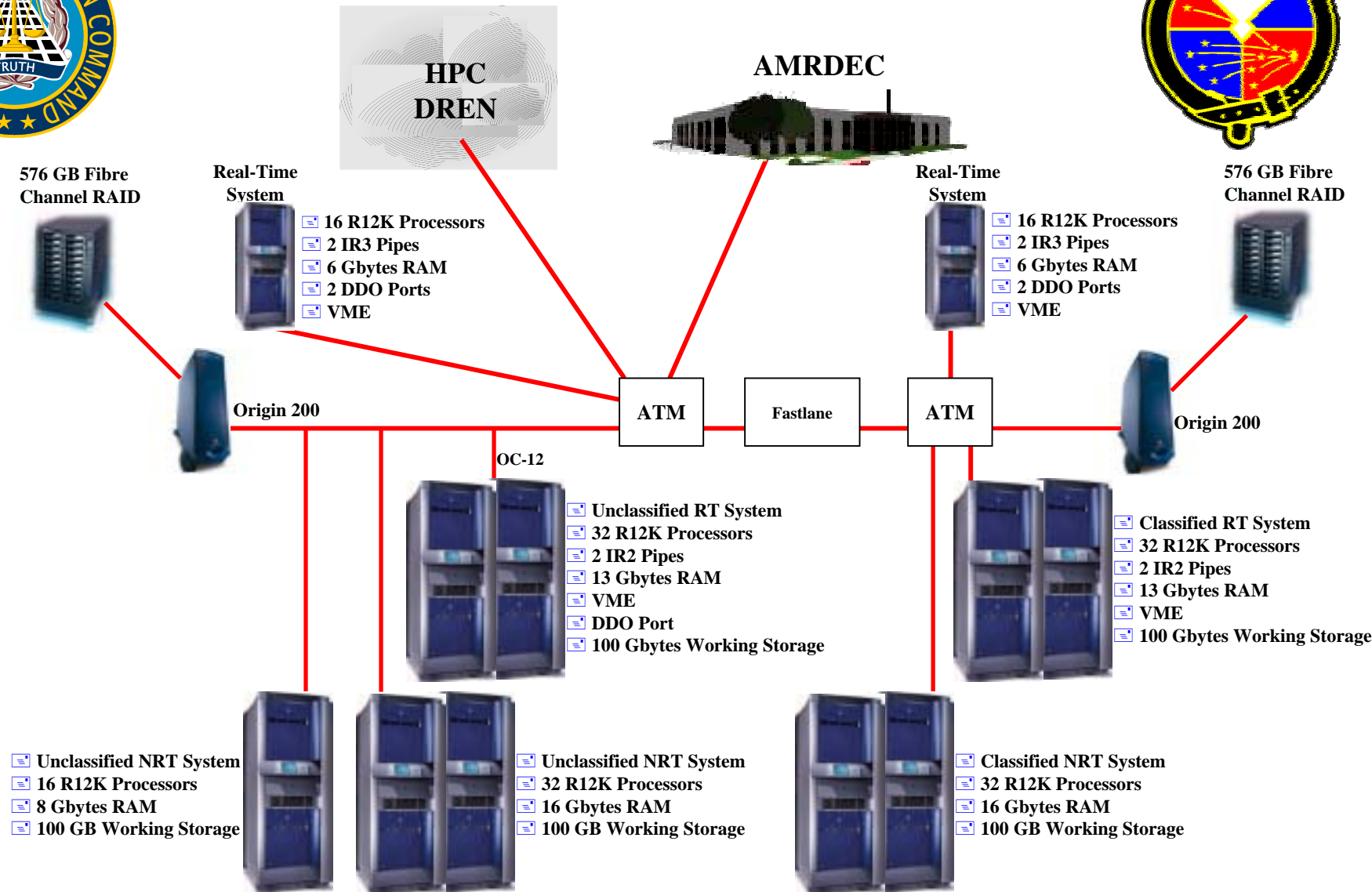
# RTTC Placement in HPCMP



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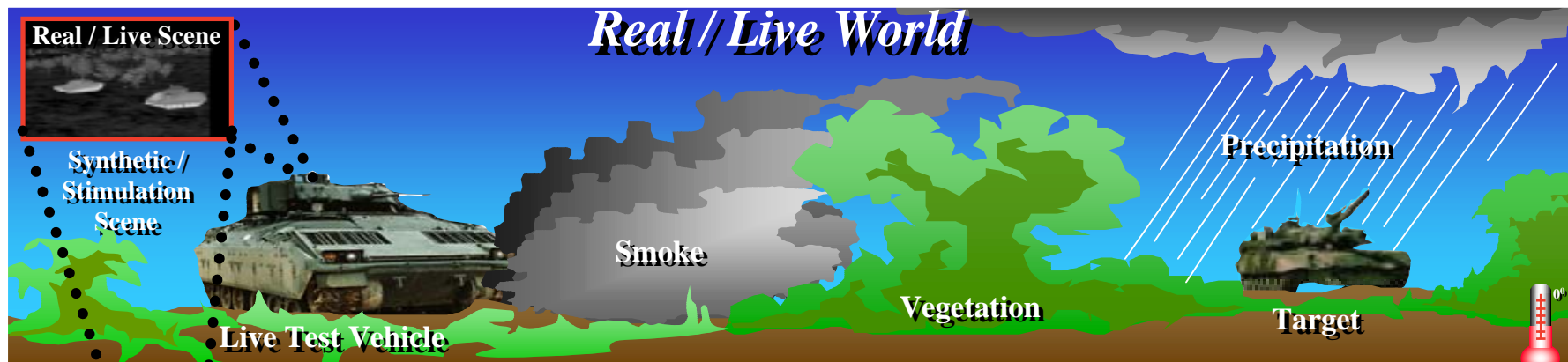
# RTTC HPC Configuration



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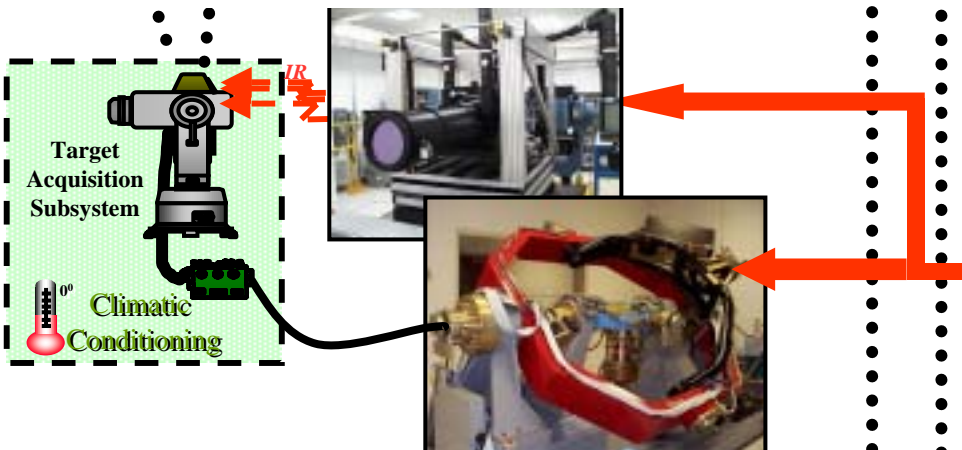


# VPG Application and DIRSP Conceptual Overview

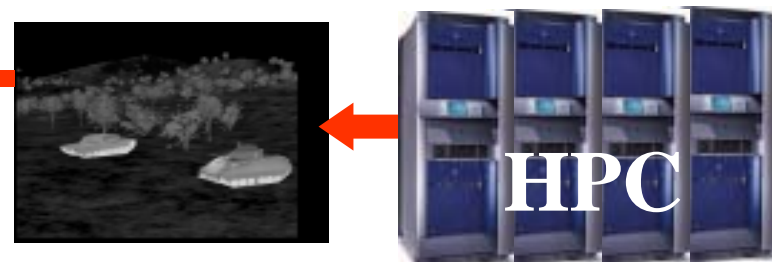


## *Synthetic / Stimulation World*

### Real-Time Hardware-In-The-Loop Test / Simulation



- Real-Time Scene Generation
- 6-DOF Simulation
- Non-Uniformity Correction
- Synthetic Environments Modeling
- Real-Time HWIL Interfaces





# Background

## VPG/DIRSP/Real-Time HPC



- DTC's Virtual Proving Ground (VPG) **Integrates** M&S Into The T&E Infrastructure.
- Dynamic Infrared Scene Projection (DIRSP) Projects Dynamic (**Real-Time**) Complex Infrared Scenes into the Entrance Aperture of Imaging Infrared Sensors.
- DIRSP Projects "**In-band**" Infrared Energy With Sufficient Fidelity For The UUT To Perceive And Respond To The Synthetic IR Scene As It Would In The Real-world.
- VPG/DIRSP/HPC Provides A Highly Effective Real-Time Infrastructure For Testing **Tactical** EO/IR Imaging Sensors/Subsystems/Systems.

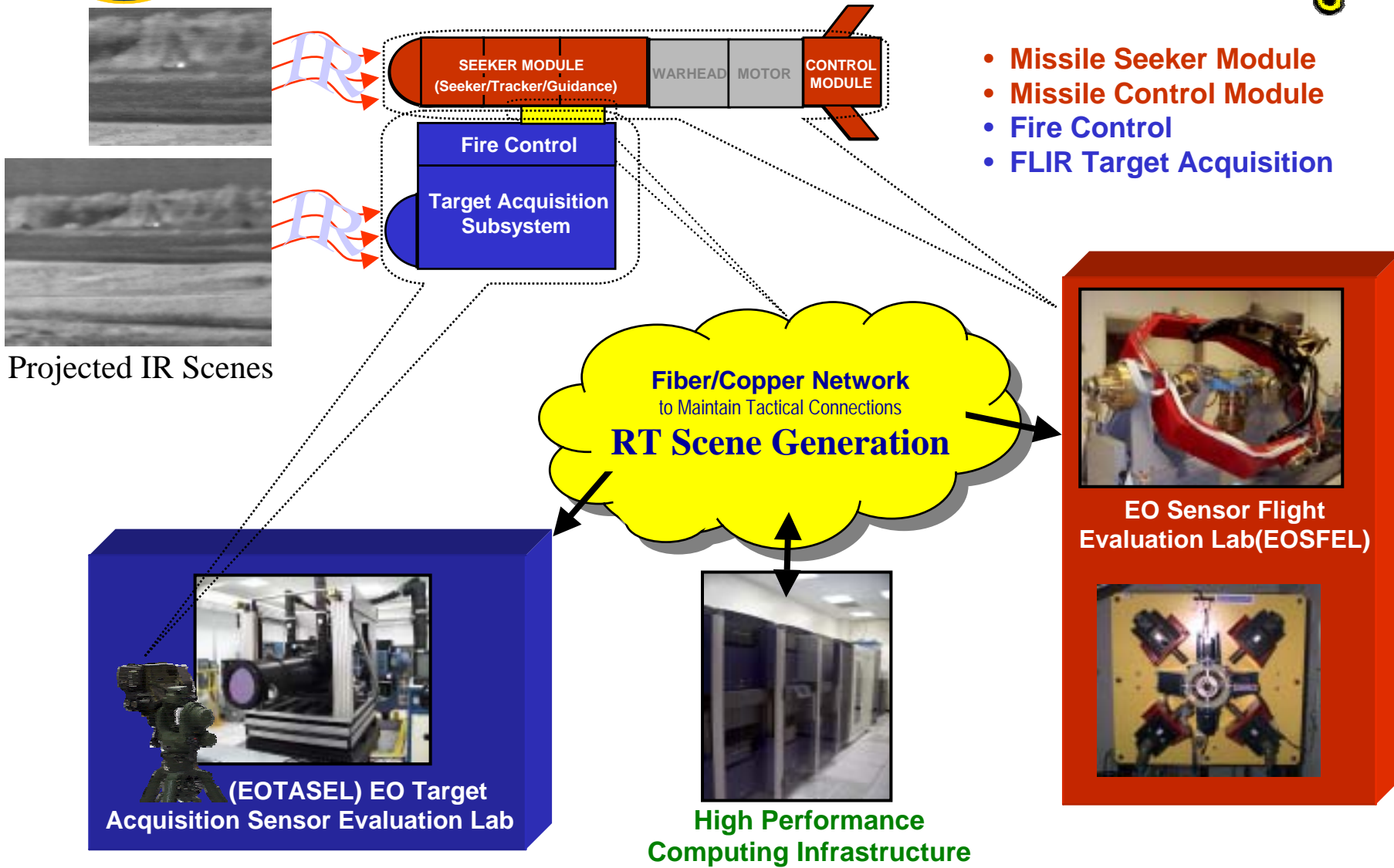




# VPG Application Using DIRSP and HPC



- Missile Seeker Module
- Missile Control Module
- Fire Control
- FLIR Target Acquisition







# Example HPC Real-Time DIRSP/VPG Application



- Domain of Application: Live Fire (HWIL) Test Rehearsal
  - Javelin: Man-Portable Imaging Infrared Missile System
    - Imaging Infrared Target Acquisition Sensor (CLU)
    - Imaging Infrared Missile Seeker
- Intended Use of RTTC HWIL Application
  - Primarily Entity/Sub-Entity Level Testing and Training (One-on-One/Few Performance)
  - “MOUT” Warfighter Scenario





# Example HPC Real-Time DIRSP/VPG Application



- Used Real Tactical Javelin Hardware (Not Trainer Hardware)
- Used Warfighters/Soldiers
- Synthetic Environment Developed For Test Support (Also Adequate For Training)
  - Target And Terrain Models
  - Infrared Scene Generation And Projection
  - Flight Motion Simulation
  - Missile Flight Dynamics Simulation
  - Real-time Interface And Architecture
- Live Missile Firings Against Real MOUT Targets (Bunker & Building)  
Subsequently Followed The Laboratory Exercise - With Excellent Success



# Javelin Missile Firing



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**Developmental Test Command**



# Example HPC Real-Time DIRSP/VPG Application



**Requirement:** Test Javelin performance against urban structures (Sand bag bunker and a concrete building)



**MOUT Structures**



**Javelin Weapon System**

## Challenges

- 1) Weapon System Performance - Missile tracker algorithms were optimized for engaging armored vehicles.
- 2) Operational Test/Training - Gunners not trained in weapon system operation against urban structures.



# Example HPC Real-Time DIRSP/VPG Application



**GOAL:** Reduce risk associated with live Missile Firings

- Develop Infrared models of the MOUT structures



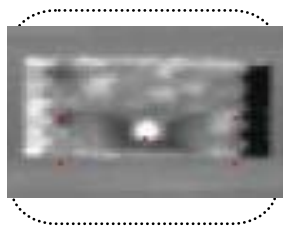
- Determine optimal weapon engagement method using missile HWIL test facility
- Allow Warfighters to rehearse using non-destructive HWIL testing prior to flight testing



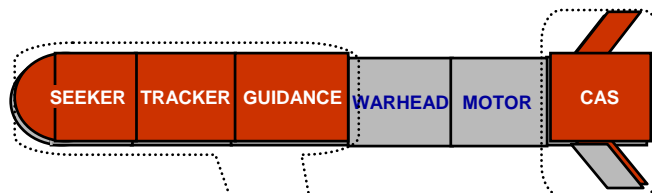
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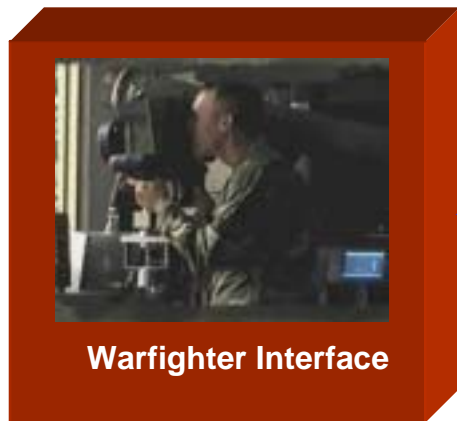
# Example HPC Real-Time DIRSP/VPG Application



**IR MOUT Targets**



- IR Seeker/Target Tracker/  
Guidance Section
- Control Actuator Section



**Warfighter Interface**



**EO Missile Subsystem  
Test Lab**

**Developmental Test Command**





# Example HPC Real-Time DIRSP/VPG Application



## HWIL

Generates Target Models for  
Structures on Ranges



## GUNNERS

Practices with Different  
Tracker Gate Placement/  
Attack Modes on Actual  
Target Model



## EXPERTS

Review Results, Refine  
Theoretical Predictions with  
Actual Gunner Experience



## TEST

Refined New Attack with  
Improved Lethality--

## SURPRISE!

Attack Buildings at Short  
Range with Top Attack!



**Developmental Test Command**







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# Bunker Live Fire Results



## Before





# Bunker Live Fire Results



**Before**



**After**

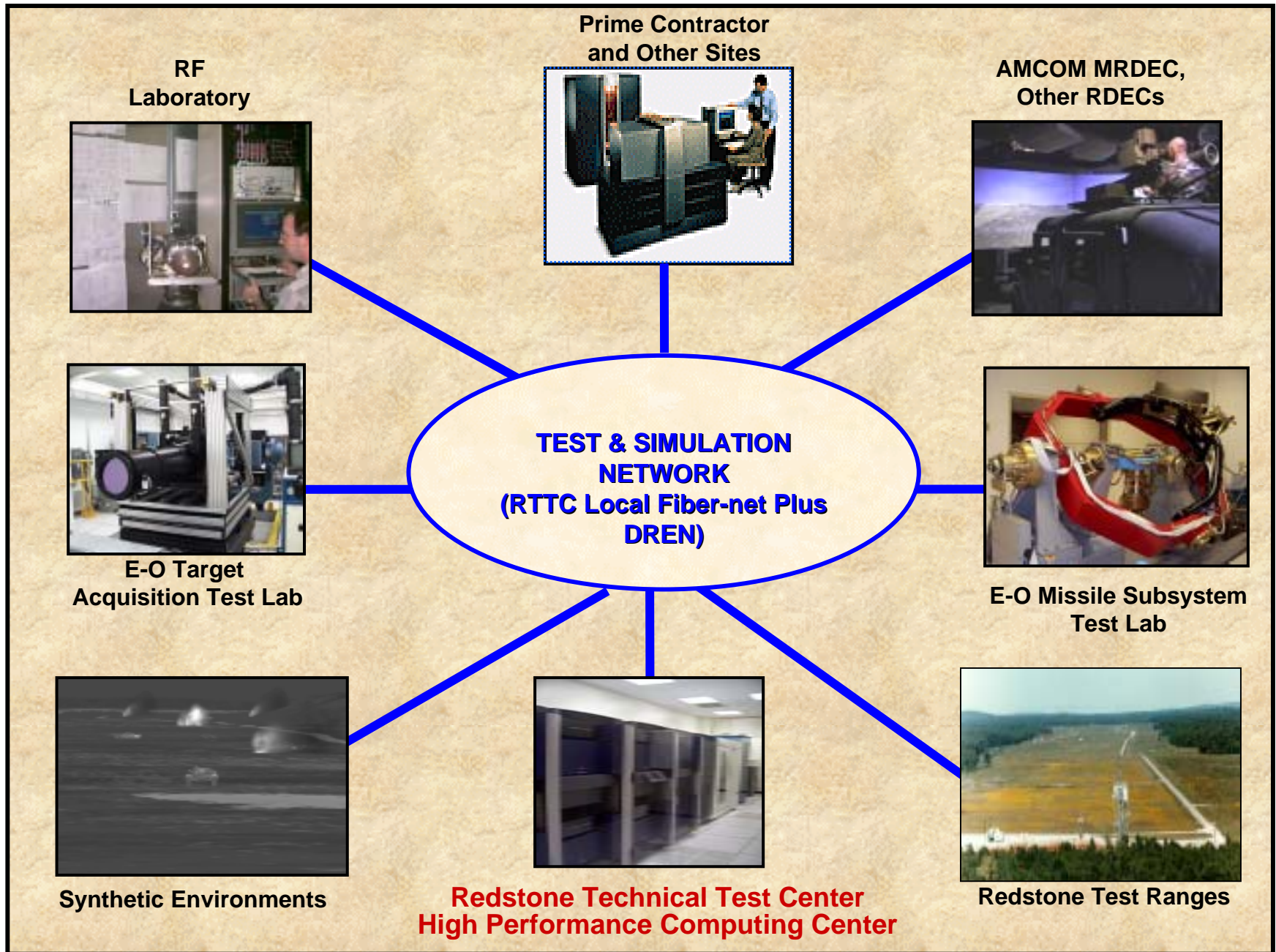




# Where are we going next?



# Test and Simulation Infrastructure



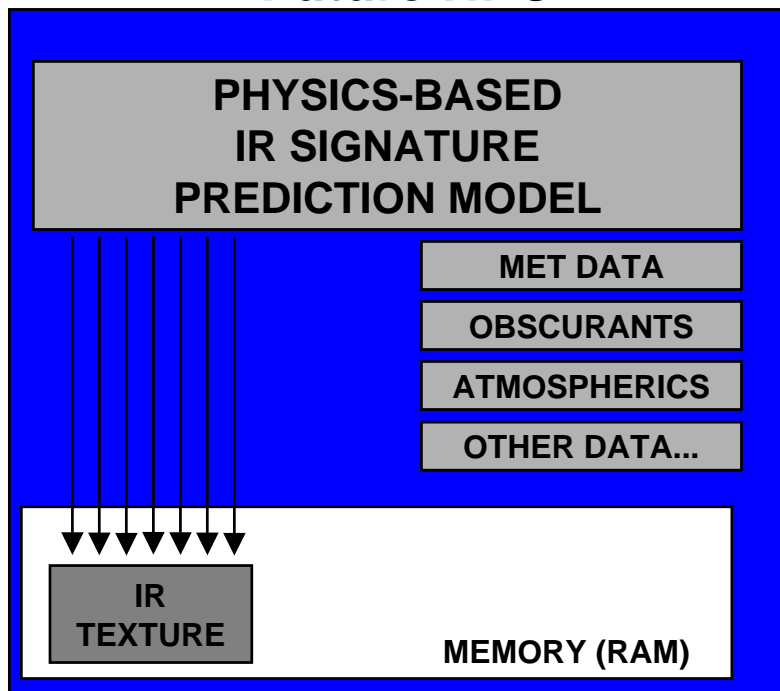




# Next Gen HPC Real-Time Physics-Based Scene Generation

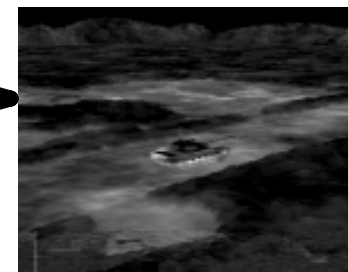
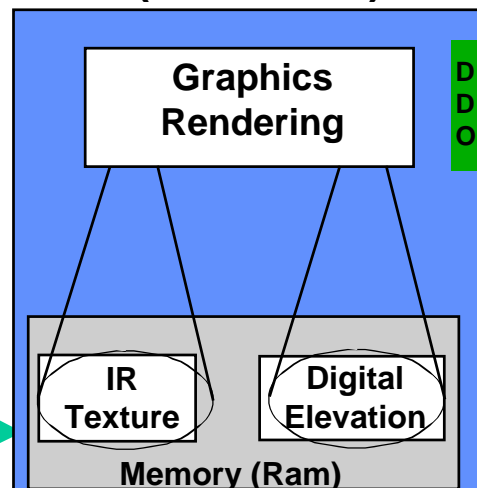


## Future HPC



High Speed LINK

## Future HPC Real-Time SCENE GENERATOR (Near UUT)



To  
Scene  
Projector

Developmental Test Command



# CONCLUSIONS



- RTTC's HPC is a Critical Resource/Tool For Test And Evaluation Of Next Generation Multispectral EO Systems
  - Real-time Hardware-in-the-Loop Operational Performance